

Sustainability and Growth

■ Atlanta, GA 'Boom Town'

- 1990's - fastest growing human settlement in history
- land area larger than the state of Delaware
- nation's longest average commute times
- 69 'ozone alert' days in 1999
- stopped highway construction until air quality issue is resolved

■ Defines 'sprawl'

- the unstoppable spread of development
 - threatens sensitive wildlife and wetland habitat
 - half of all Florida wetlands - lost
 - 90% of California coastal ecosystems - lost
- huge Environmental impacts

Sustainability

- It is not only what you build but where you build it
- Are there alternatives to Sprawl?

The Green Neighborhood

Sustainable Family Housing Design

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U.S. Army Construction Engineering Research Laboratory

The Built Environment

- A significant impact on available natural resources
- Globally, the building industry consumes
 - 40% of the raw stone, gravel, and sand
 - 25% of the virgin timber
- In the United States, buildings consume
 - 31% of the total energy expended each year
 - 50% of the SO_2
 - 25% of the NO_x
 - 35% of the CO_2 produced
 - \$ 210 billion for energy each year
 - \$120 billion for residential
 - \$90 billion for commercial buildings
 - 28% publicly held and 78% of the buildings private

There are more than 76 million residential buildings and nearly 5 million commercial buildings in the U.S. today

Another 38 million buildings are expected to be constructed by 2010 (doe)

The challenge will be to build them intelligently, so that they use a minimum of nonrenewable energy, produce a minimum of pollution and wastes, and cost a minimum of energy dollars, while increasing the comfort, health, and safety of the people who live and work in them.

The Design of More Sustainable Buildings

■ Goals of Sustainable Design

- Greening of Buildings
 - Building Energy (fossil & renewable)
 - Building IAQ
 - Building Material Selection
 - Construction and Building Waste Streams
- Building Operations and Maintenance
- Infrastructure and Built Environment

Sustainable Design Is More...

- Sustainable Communities
- Community Energy Consumption
- Energy Supply and Production
- Pollution Prevention
- Water Quality
- Water Quantity
- Reduced Infrastructure
- Quality of Life Issues
- Encroachment

Sustainable Army

- Why don't we get sustainable designs/development?
 - building delivery process
 - buy-in from the Corps
 - education
 - AE's
 - USACE
 - User Community
- How do we improve the overall sustainability of the Army and DOD?
 - regulation
 - performance based guidelines
- How do we redirect DOD policy to include sustainable design/development concepts?
- How do these ideas get implemented?

Green Neighborhood Objectives toward a sustainable solution

■ Improve Quality-of-Life

- Family satisfaction
- Soldier retention
- Safety

■ Life-Cycle Costs

- Energy and water efficiency
- Maintenance & 'city services' cost effectiveness
- Resource efficient

■ Reduce Negative Environmental Impact

- Integrate development with natural systems
- Material selection
 - Embodied energy/recycled content
 - local materials

Green Development Process

an integrated design approach

■ Multidisciplinary Design Team Approach

- Architects
- Landscape Architects
- Urban Planners
- Mechanical Engineers
- Electrical, Civil and Environmental Engineers
- Residents
 - Focus Groups

■ Site-Specific Design

- Climate specific design
- Existing terrains and site characteristics to remain
- Regional vernacular architecture

Site-Specific Design

Examples

■ Location: Fort Hood, TX

- 150 units/ 4-5 bedroom (Junior NCO)
- Cooling dominated climate
 - DoE/EPA/DoD cool communities initiative

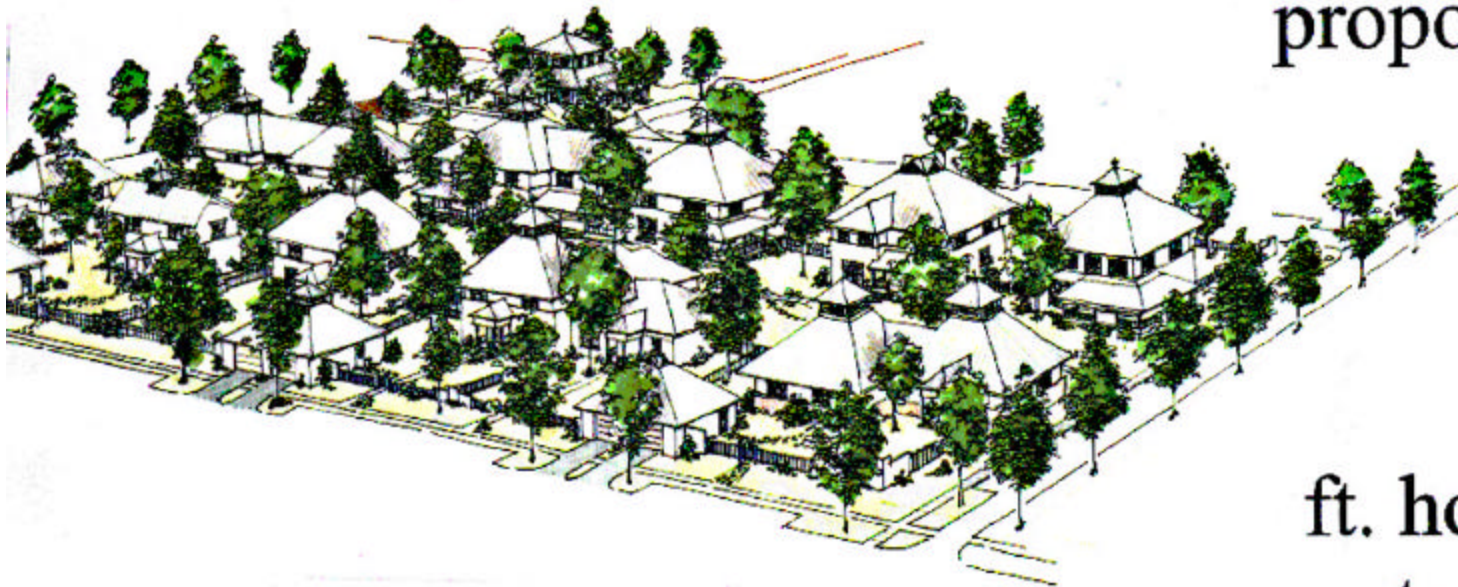
■ Location: US Military Academy at West Point

- 77 units/ 3,4 & 5 bedroom (enlisted - NCO)
- Heating dominated climate

■ Site Selection

- Infill area
- Existing land use practices

a
green
neighborhood
proposal



ft. hood
texas

construction engineering research laboratory

Master Plans

■ Resource conscious infrastructure

- Integrate infrastructure with natural habitat
- Native species inclusion

■ Transportation design

- Narrower street layout
 - slow traffic/reduce auto speeds
- Provide for mass transportation
- Design around pedestrian networks

■ Neo Traditional approach

- Allows for ecologically sensitive land use practices
- Encourages community interaction
 - reduce crime potential
- Enhanced wayfinding

Ft Hood Neighborhood Plan

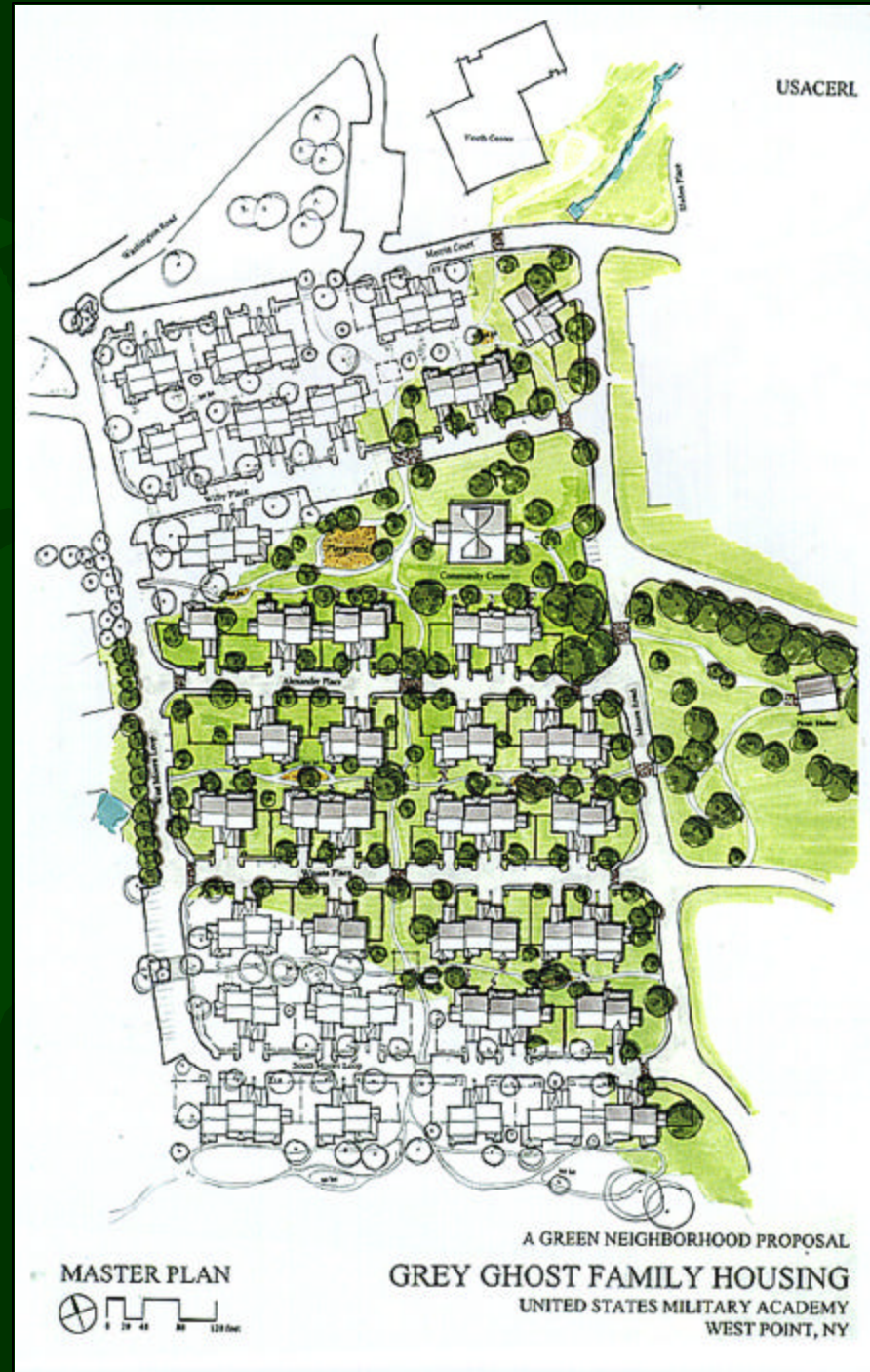


en neighborhood

US Military Academy at West Point

Grey Ghost Family Housing Project

- existing site
- re-use existing infrastructure
- create pedestrian pathways
- community center
- off and on-street parking
- buffer views
- create neighborhood blocks



Cluster and Block Development

sprawl vs cluster development

Collect unusable space

- develop high-quality open space

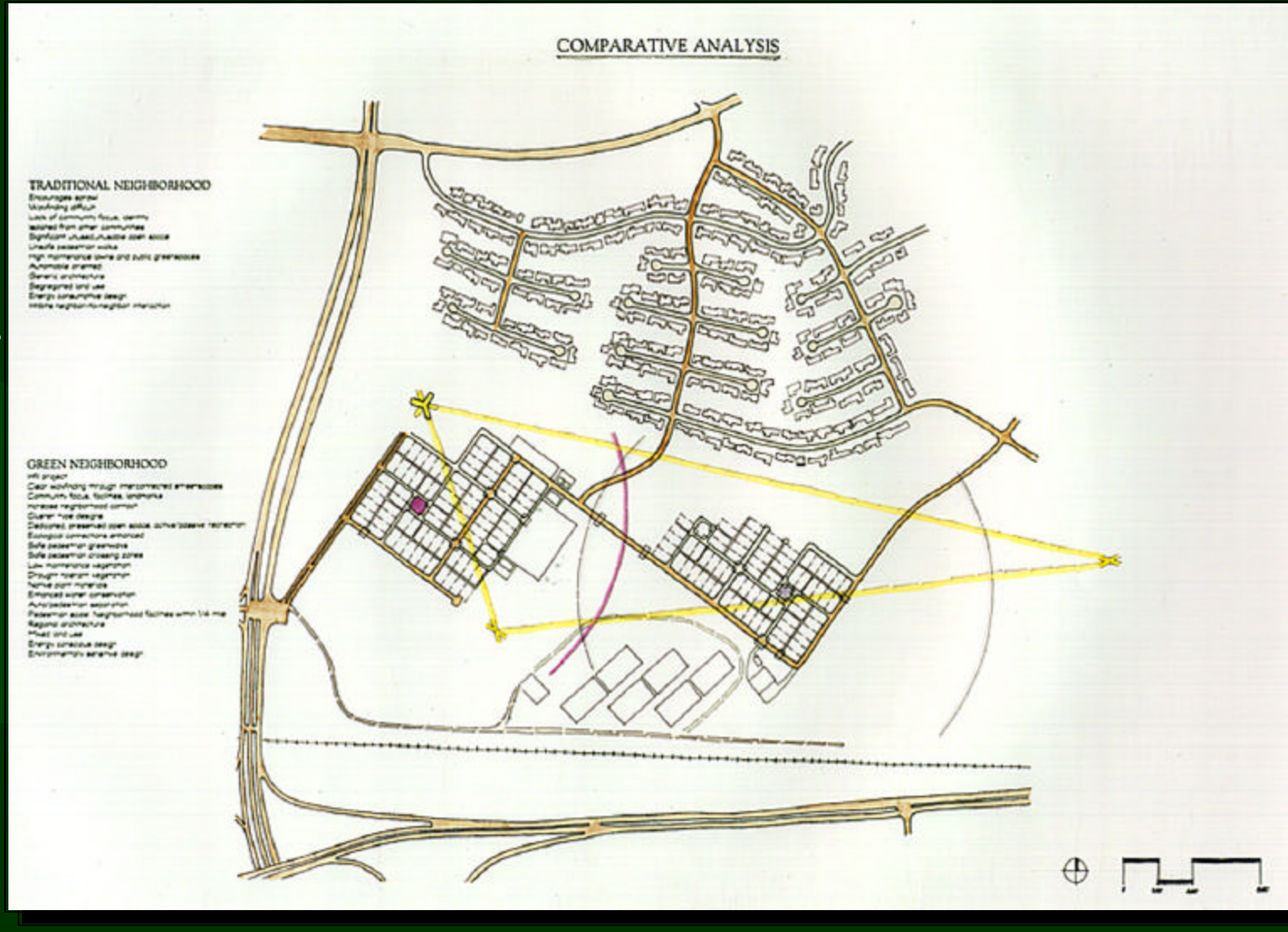
Cluster development patterns

- walkable communities
- sense of place
- reduced development impact

Neighborhood focus

- neo traditional approach

Recreational opportunities



Opportunity Costs

- A 1996 national home buyer's survey revealed that nearly three-fourths of all buyers would pay more to live in a community "where I can walk or bicycle everywhere"
- A study in northern Virginia showed that fringe residential development costs more to serve than it generates in tax revenue
 - farms generate \$1 in revenue for every \$0.21 of services needed
 - fringe development costs \$1.20 in services for every \$1 they generate.
 - the average annual revenue shortfall
 - \$2200 per dwelling for a low-density development that of a high-density development
 - \$700 per dwelling a high-density development

Block Plans

■ Enhanced Quality of Life

- increased sense of community
- community / recreational centers
- greenway access
- neighborhood garden plots

■ The Neighborhood

- limited area
- mixed dwelling units
- access to neighborhood centers
- balanced mix of activities

■ The Street

- building block of neighborhood
- promote pedestrian use by design

■ The Residence

- cluster type design to promote open space
- energy efficiency requirements
- layout maximizes usable spaces - increased efficiency

en neighborhood

Ft Hood Block Plan

BLOCK PLAN

HOUSING UNITS

12 Units/Block
8 Units/Streetcar
Required Unit Configuration
(min)

4/Street
1 Ranch Unit
1 Attached Unit
1 Corner Unit

UNIT SITE REQUIREMENTS

1 Car Garage/Unit
Attached Covered Porches
(Front & Rear)
Hardscape Fence
Configuration
to Promote Privacy
Canopies
Shade Trees
Pedestrian Way Orientation
Pavement Walkways

SETBACK REQUIREMENTS

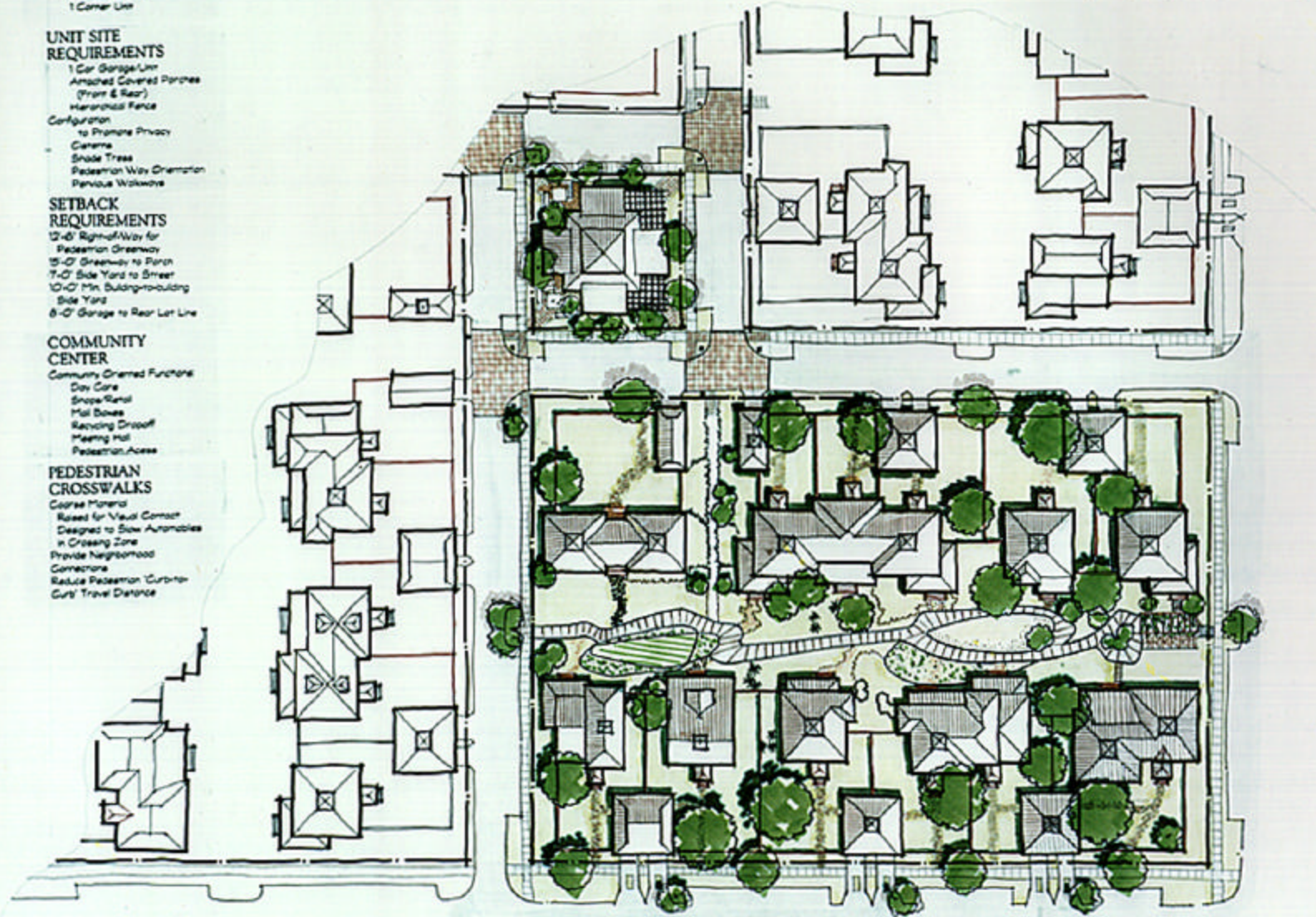
12'-6" Right-of-Way for
Pedestrian Greenway
15'-0" Greenway to Porch
7'-0" Side Yard to Street
10'-0" Min. Building-to-Building
Side Yard
8'-0" Garage to Rear Lot Line

COMMUNITY CENTER

Community Oriented Functions
Day Care
Shops/Retail
Mail Boxes
Recycling Dropoff
Meeting Hall
Pedestrian Access

PEDESTRIAN CROSSWALKS

Cooler Material
Raised for Visual Contact
Designed to Slow Automobiles
in Crossing Zone
Provide Neighborhood
Connections
Reduce Pedestrian Turn-of-
Gulf Travel Distance



Housing Prototypes

- Vernacular architecture
 - site specific design
- Modular construction techniques
 - structural insulated panels
 - reduced costs
 - increased energy efficiency
- Materials
 - low impact ('embodied energy')
 - high recycled content
 - safe, non-toxic
- Improved envelope/fenestration
 - design for daylighting
 - increased insulation
 - natural ventilation/indoor air quality
 - high albedo materials
- Layout
 - increases efficiency
 - promotes privacy aspects

Sustainable Materials

attributes

- Low Lifecycle Impacts
- Low Embodied Energy
- High Recyclable and Recycled Content
- Low Toxicity
- Low Maintenance Requirements/Durability
- Uses Renewable Resources
- Uses Local Resources
- Is a Reusable Resource
- Uses Sustainable Manufacturing /Harvesting Practices

CO2 balanced - no net addition of CO2 from material

A GREEN NEIGHBORHOOD PROPOSAL

USACERL / University of Illinois
collaborative design

FT. HOOD, TEXAS

HOUSING PROTOTYPES



GREENWAY ELEVATION



PLAN VIEW

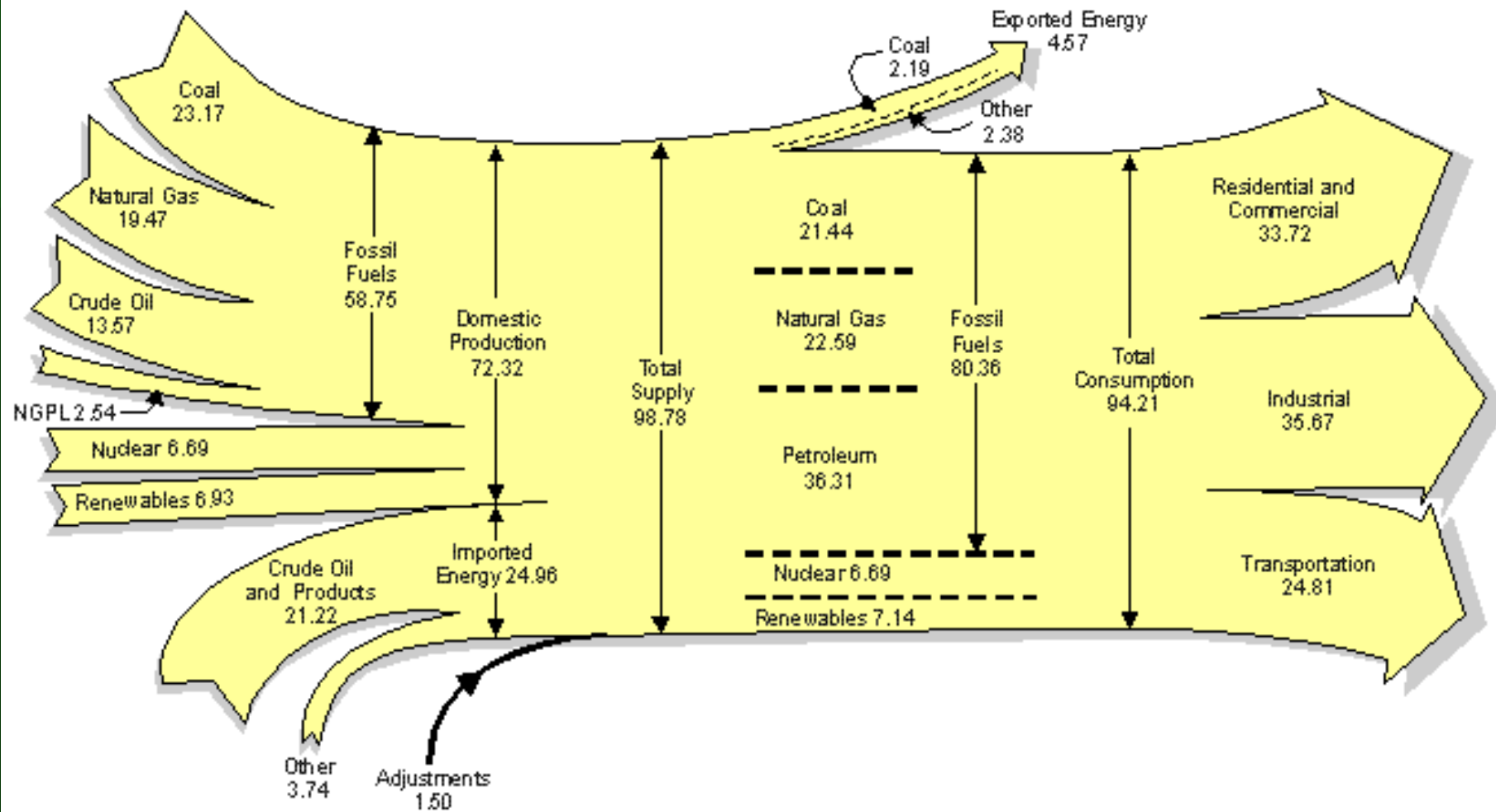


STREET ELEVATION

Ft

ERDC/CE

U.S. Energy Flows - 1997



Residential Component Loads

Component	Loads (quads) and Percent of Total Loads			
	Heating		Cooling	
Roof	-0.65	12%	0.16	14%
Walls	-1.00	19%	0.11	10%
Foundation	-0.76	15%	-0.07	-
Infiltration	-1.47	28%	0.19	16%
Windows (conduction)	-1.34	26%	0.01	1%
Windows (solar gain)	0.43	-	0.37	32%
Internal Gains	0.79	-	0.31	27%
NET Load	-3.99	100%	1.08	100%

LBL 1997

Integrated Energy Savings

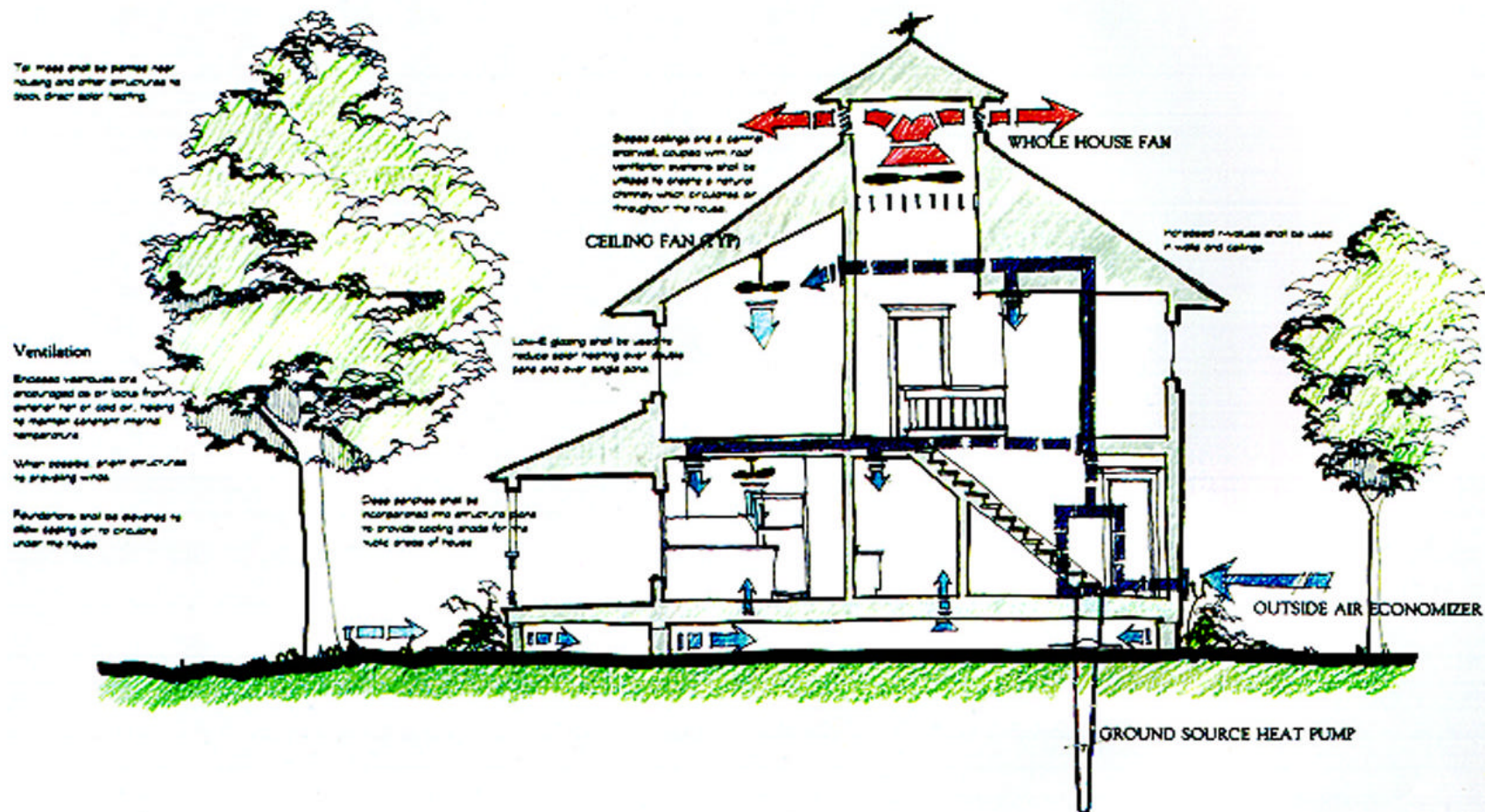
- Advanced technologies
 - high efficiency
 - holistic ventilation system
 - appropriate use of renewable sources
 - improved natural circulation
- Efficient appliances
 - EPA refrigerator program
 - lighting
- Storm water engineering
 - cisterns
 - overland collection system
- Material selection
 - high albedo
 - thermal qualities
 - low maintenance
- Construction techniques
 - decrease infiltration

The life cycle energy consumption of a typical new house is 2,525 barrels of oil, only 6.3% of which is embodied energy, versus 927 barrels for the same house with energy efficient design.

(Blanchard and Reppe <http://www.umich.edu/~nppcpub/research/lcahome>)

Integrated Energy Design

INTEGRATED ENERGY SAVINGS MEASURES



Energy Analysis

■ Baseline energy analysis

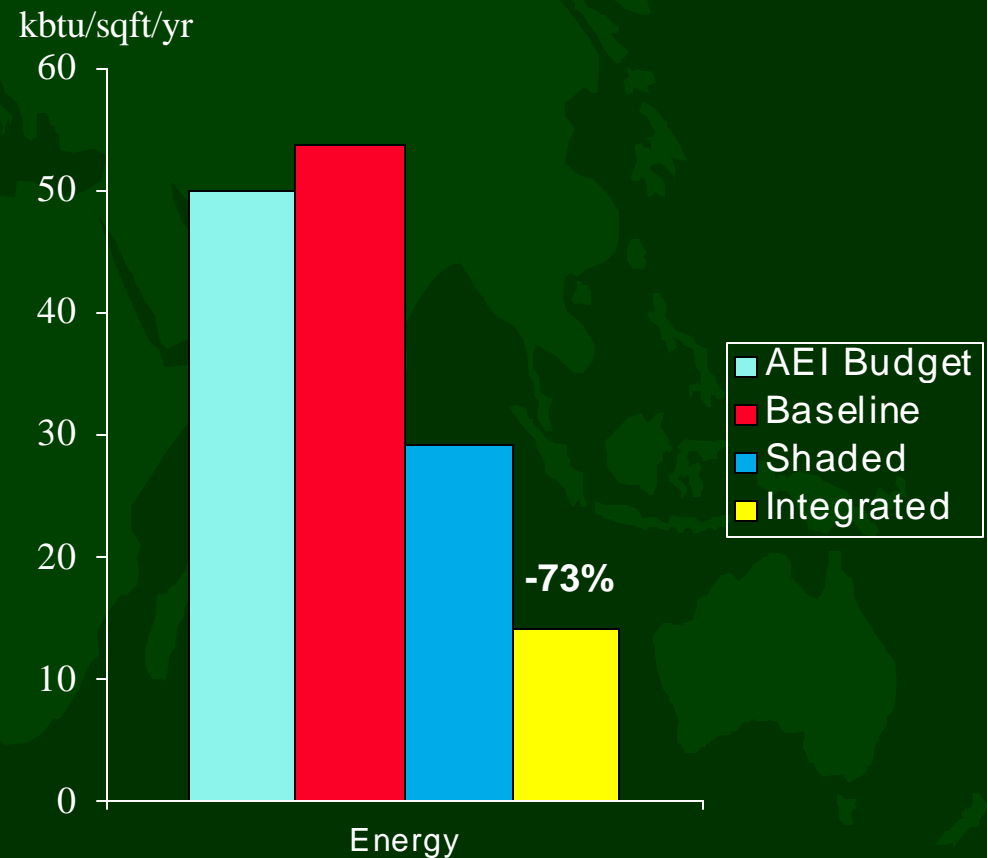
- Conventional hvac system
- Standard construction techniques
- Standard landscaping practices

■ Integrated energy savings

- Advanced hvac technologies
- Appropriate technology
- Renewable resources
- Holistic, natural ventilation
- Vegetative cooling techniques

■ Findings

- Over 70% reduction in energy consumption for the Integrated approach

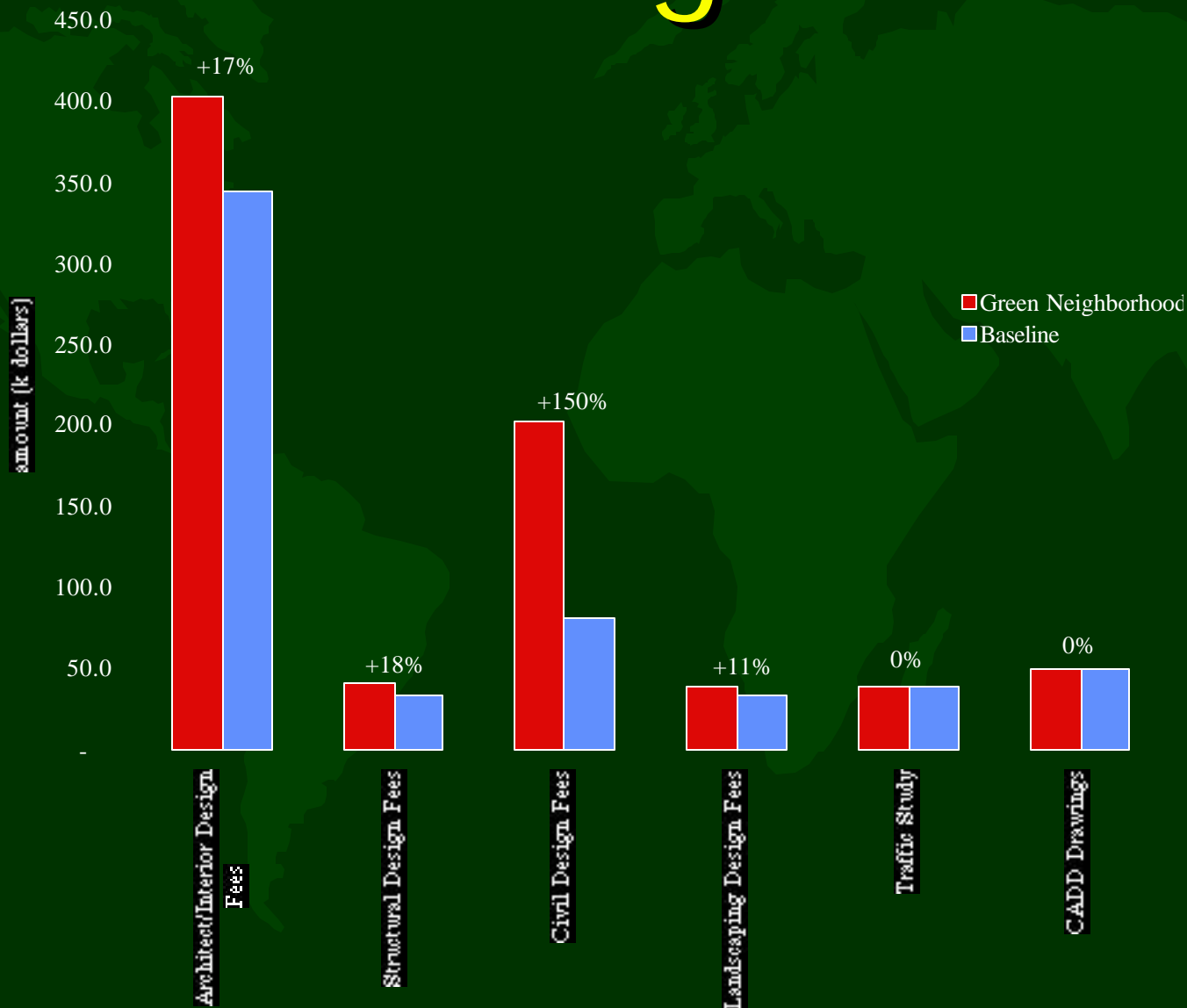


Cost Analysis

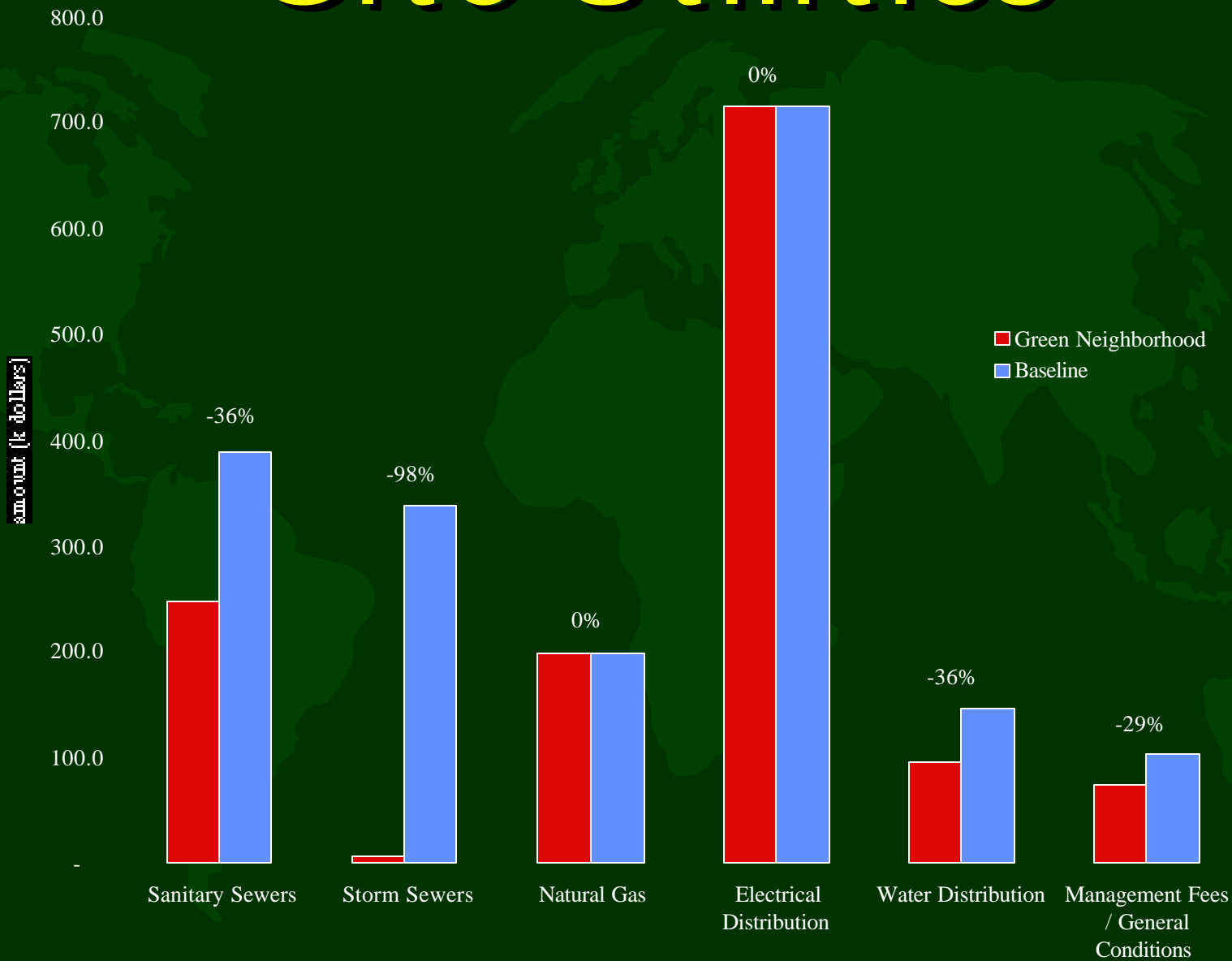
major components

- Design Fees
- Site Utilities
- Recreational Areas
- Landscaping
- Site Development
- Housing Unit Costs

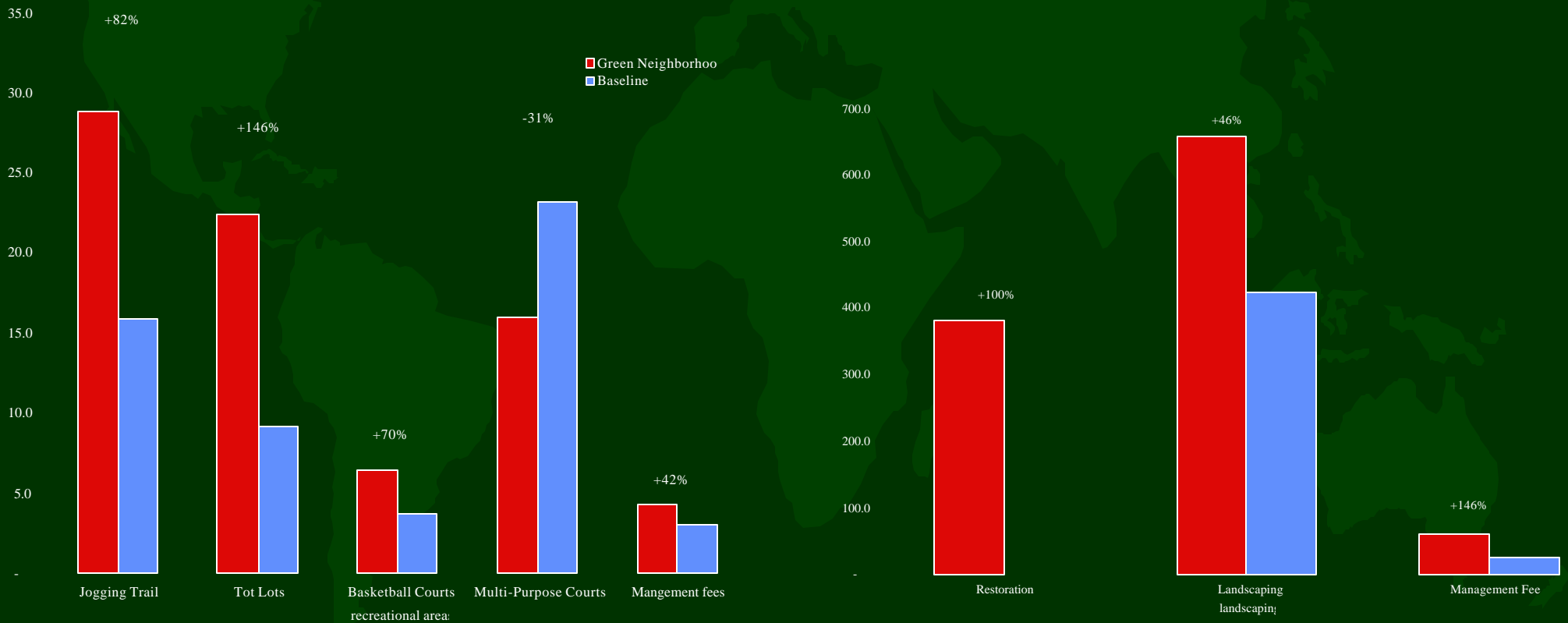
Design Fees



Site Utilities

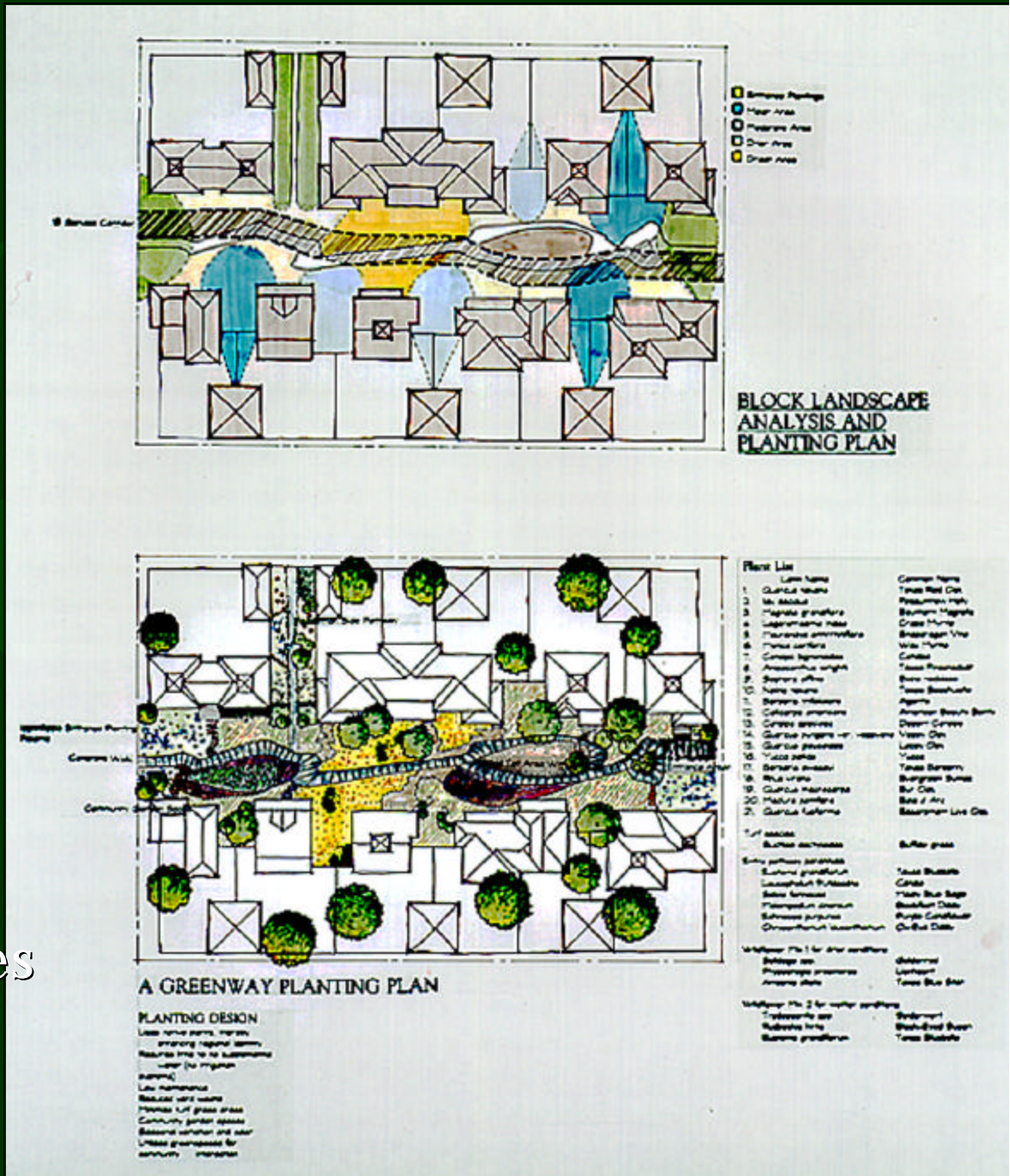


Recreational Areas and Landscaping

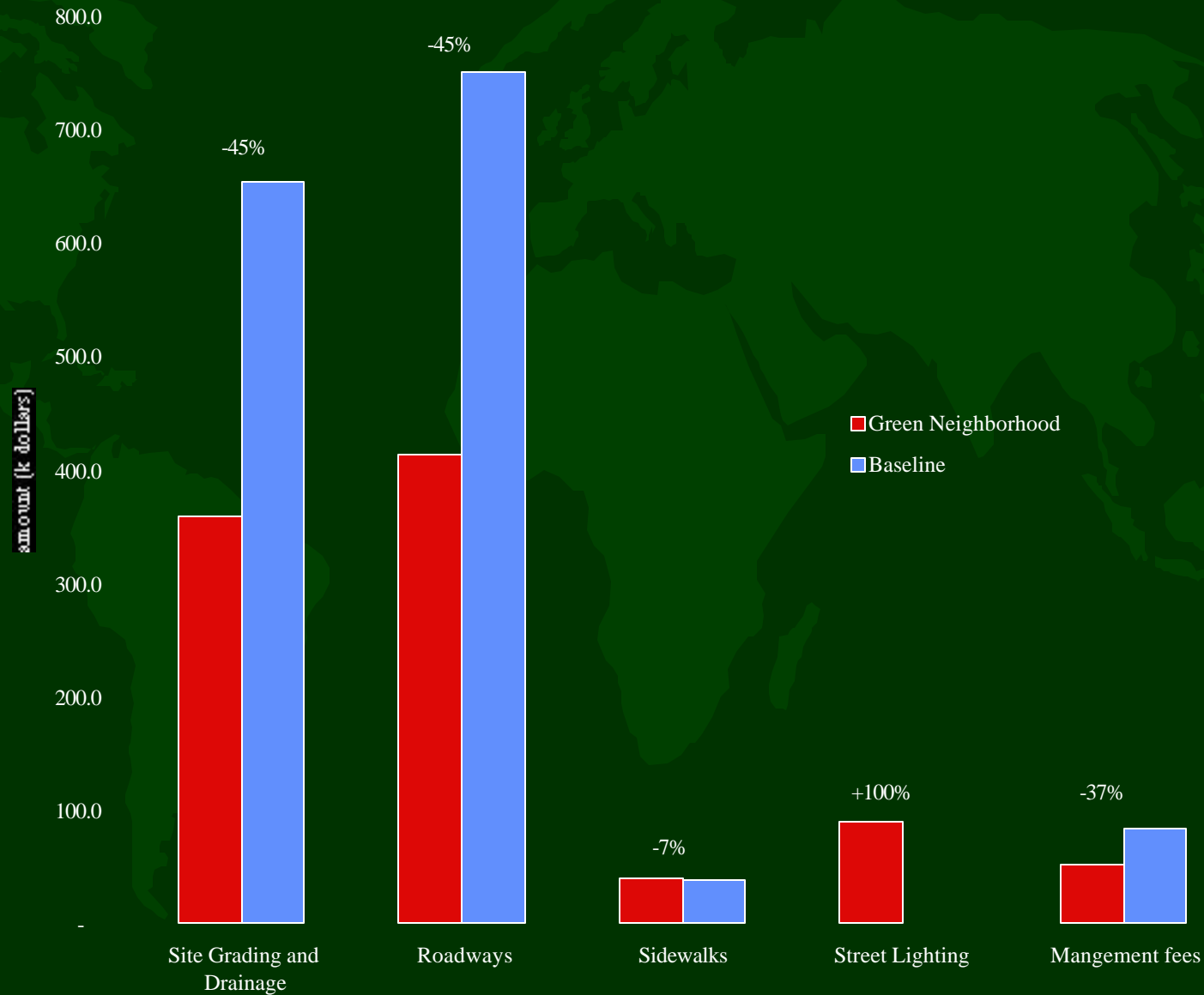


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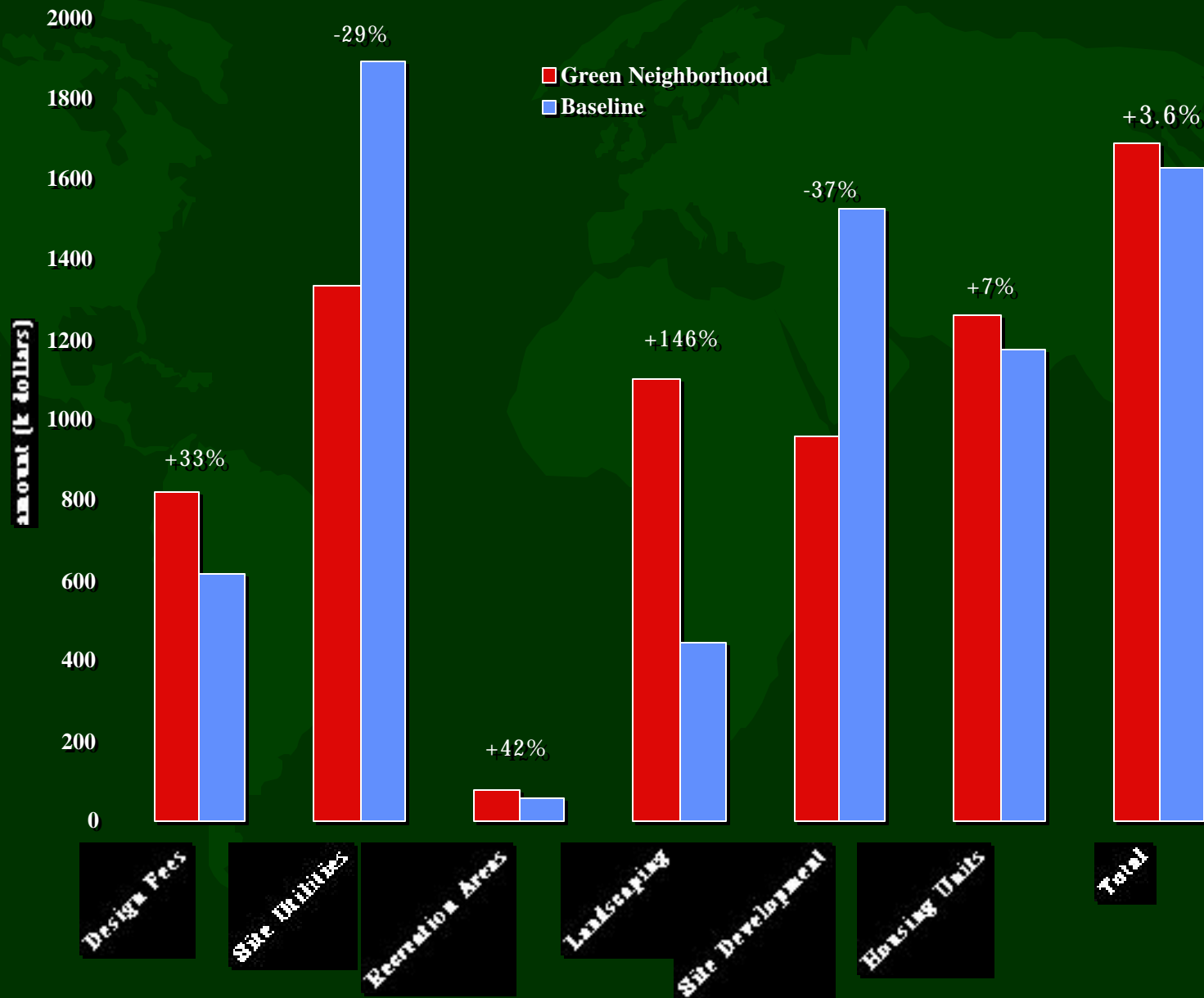
- Vegetative shading devices



Site Development



Total Costs



Housing Units

■ Cost Increases

- stressed skin panels
- windows
- roofing material
- exterior finish
- plumbing fixtures
- kitchen area
- efficient hvac system

■ Cost Savings

- carpentry labor
- interior partitions
- additional insulation
- exterior flatwork



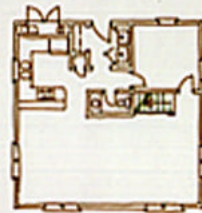
A GREEN NEIGHBORHOOD PROPOSAL FT. HOOD, TEXAS

Jeffrey Adams, Jon Bosler
Allen Chalifoux,
Brian Deal, Larissa Larsen,
Virge Jenkins Temme

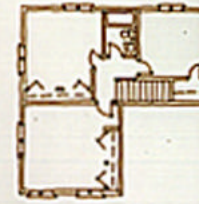
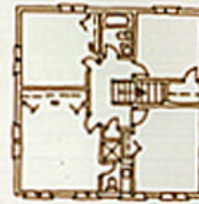
MODULAR DESIGN ELEMENTS

Basic Module

The basic module is a 20'x20' square footprint. Layout of the living floor is generally unshared between houses. Showers are converted to follow in single entry configurations. Mechanical closets may be located as indicated here, or in the rear vestibule, with additional space used for the kitchen.



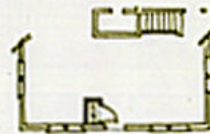
The sleeping floor, composed of four 14.5'x14.5' squares can be assembled as needed to create 2-, 3-, or 4-bedrooms. A second bath may be included, as indicated here. Otherwise, the space may serve as closets and additional bedroom footage.



Attachments

Attachments to the basic module may include:

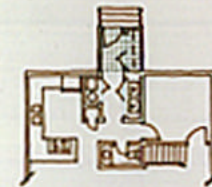
A 2'-7" x 3' door closet may be located inside the front entrance door.



14'-2" x 3' bays may be used to expand living or sleeping areas as needed.



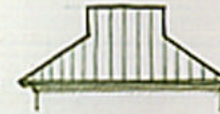
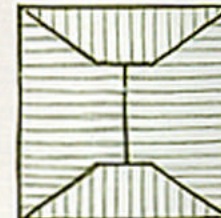
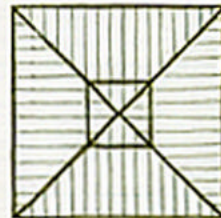
A 7'-0" rear enclosed vestibule may contain a mechanical or coat closet, and which supports a catwalk within the roof structure.



Roof

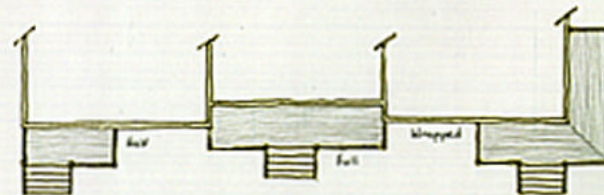
Roof Ventilation

Roof drives include hips, or hip-and-gables - all at an 8:12 pitch, with varying of the uppermost peak to allow whole-house ventilation. Chimneys are 24" deep. Baffles are, vented outside, and gable vents aid in creating a natural chimney effect for whole-house ventilation.

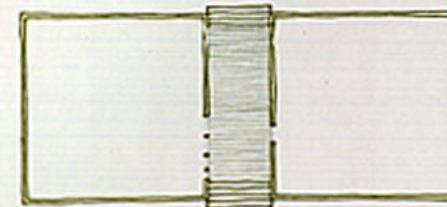


Porches

All house plans incorporate porches which are equal in depth to 1/4 module, or 7'-3". They may extend the full width of the house, 1/2 of the width, or may wrap around one corner of the house. All porches are to have railings.



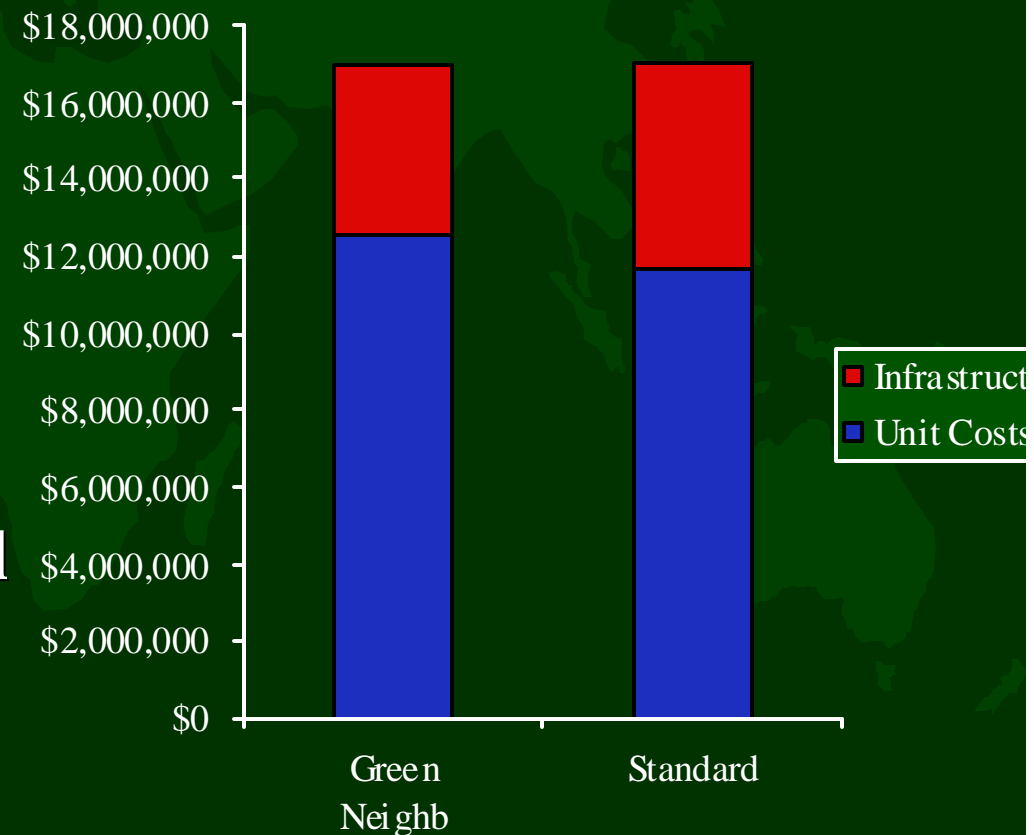
Dog Trot



Cost vs. Standard Practice

- Design - increased cost at conceptual phases
- Construction
 - infrastructure: 20% reduction
 - buildings: 10% increase
 - infrastructure savings have financed better buildings
- Operation (Energy) - reduced
- Maintenance - reduced

Green Neighborhood Cost Analysis



Conclusions

- A concern for the environment has spawned research that is beginning to outline the benefits of conserving and restoring our natural landscape. Sustainability challenges the guidelines and processes of existing housing development. The existing substandard housing cycle is developed from guidelines that sacrifice the long range benefits of effective planning, design and construction for the short range benefits of front-end cost saving measures.
- The hypothesis that the front-end costs of the existing housing development paradigm is significantly lower than neo-traditional, ecologically sensitive planning is refuted through this cost comparison analysis. Although front-end design and planning costs raise the project cost slightly higher than the prevailing 'sprawl' cost, the long range energy saving benefits are projected to save significantly in the future.
- This cost analysis outlines the importance of design as a tool for providing high quality, well constructed housing developments at reasonable costs.



GREENWAY